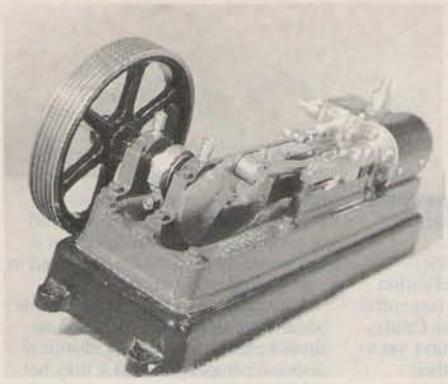


SALLY

The flywheel and starting on the cylinder

With the bedplate now completed and ready to act as a firm base for the engine; it is now time to make a start on the moving components of the engine, says Tubal Cain.

● *Part III from page 344 (18 September 1992)*

Flywheel, part 39, Fig. 14.

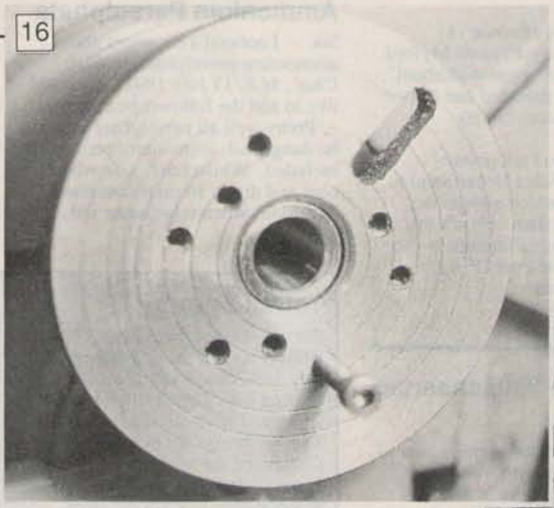
You must first decide what type of rim you intend to use, that shown on the drawing is intended only as a guide as to how deep you can go. If the engine will always be run solo then a plain rim with no grooves is quite in order, for you can always add a pulley alongside later. A true mill engine would have multiple rope drive grooves. The Stuart wheel is rather underscale size for the engine, but even so perhaps 8 ropes 1in. dia. (full size) would carry the power. I have, in **Fig. 15**, shown only five, which will "look about right" and at the same time accept the model power. The grooves will match either the Mamod drive springs, the thinner gauge Meccano rubber bands or, as I use, 1/16in. 'O' ring material jointed with instant glue. If you intend to drive the Stuart Dynamo it is an easy job to make a new pulley for it (not more than ⅜in diameter) to match. The angle should be 45 deg., but 55 deg., as used in screwcutting, is quite satisfactory.

You will not be able to hold the casting in a 4-jaw chuck, and I cannot recommend the practice of boring the hole and then finishing the wheel on a mandrel! My photo, **Fig. 16**, shows the mini-faceplate I have made from my lathe catch-plate. After facing truly a series of grooves at ¼in. spacing are cut to aid centring. Then three ¼in. BSF (26 TPI) holes at 1¾in. PCD and another three at 2¼in. will carry most small jobs. (The two "extras" were for a special purpose.)

First mount the wheel in your 3-jaw. Try it both ways round to get the least "wobble". Skim the side face, reverse, and skim the other side, running at no more than 50 rpm and taking off only as much as is necessary to clean up. Then mount on the little faceplate with pieces of ⅛in. thick brass behind; secure these with instant glue, or they will fall out. Adjust the position of the casting until the inside of the rim runs reasonably true; you may have to compromise with the truth of the boss, **Fig. 17**. Measure the width of the rim, and take off half the machining allowance needed to bring it down to ½in. 60-70 rpm, feeding at about 0.005 in./rev. The tool should have about 7 deg. of top rake and clearance angles. Hone the tool for the final finishing cut.

The overall diameter is not critical, so start with a 15 thou deep cut under power feed at 0.005 in./rev. until you have cleaned up. Check first that the tool will clear the faceplate and that (on a Myford) the leadscrew guard is also clear. Re-hone the tool for the final cut, taking off not less than 3 thou, feeding at 0.03 in./rev. You can speed up to 80 rpm for finishing.

Now for the grooves (refer back to **Fig. 15**). The tool is a normal screwcutting shape, but should have no more than a very small radius at the nose. Set it with minimum projection in the toolpost and use your gauge to set it true and at dead centre height. Set the point close to the work at ⅛in. from the R.H. face, as near as you can measure by rule. Lock the saddle and set the topslide index to zero. Feed in gently untill you touch the work, then set the cross-slide index to zero. Then, running at 60/70 rpm, feed in slowly until you have a depth of 0.070 inch. You need have no qualms, and no need to cut first one side and then the other. Just keep the feed nice and steady! Now



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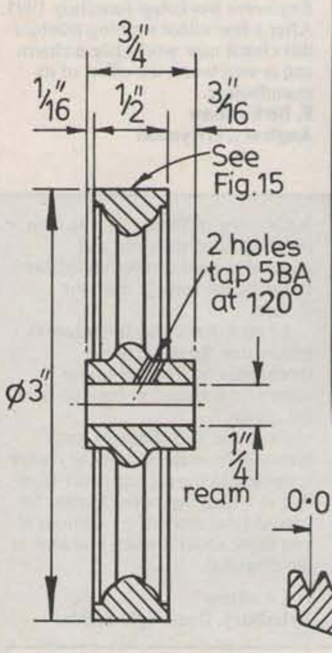
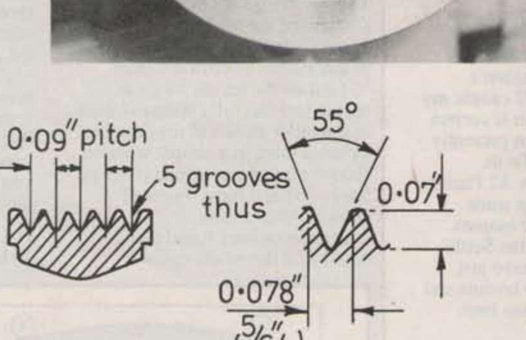
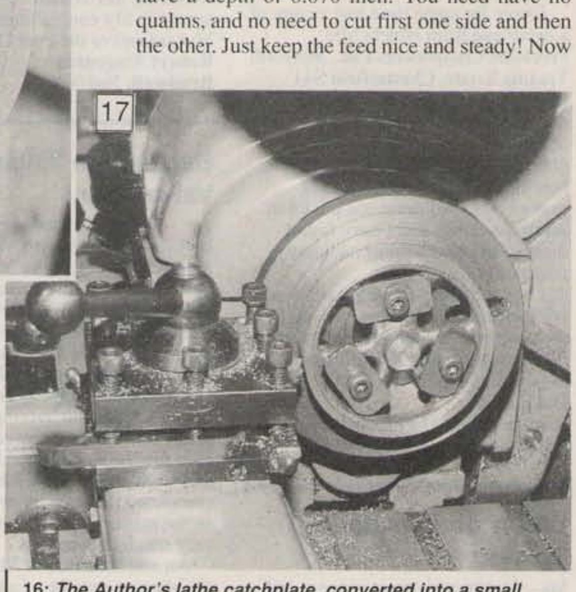


FLYWHEEL
Fig.14



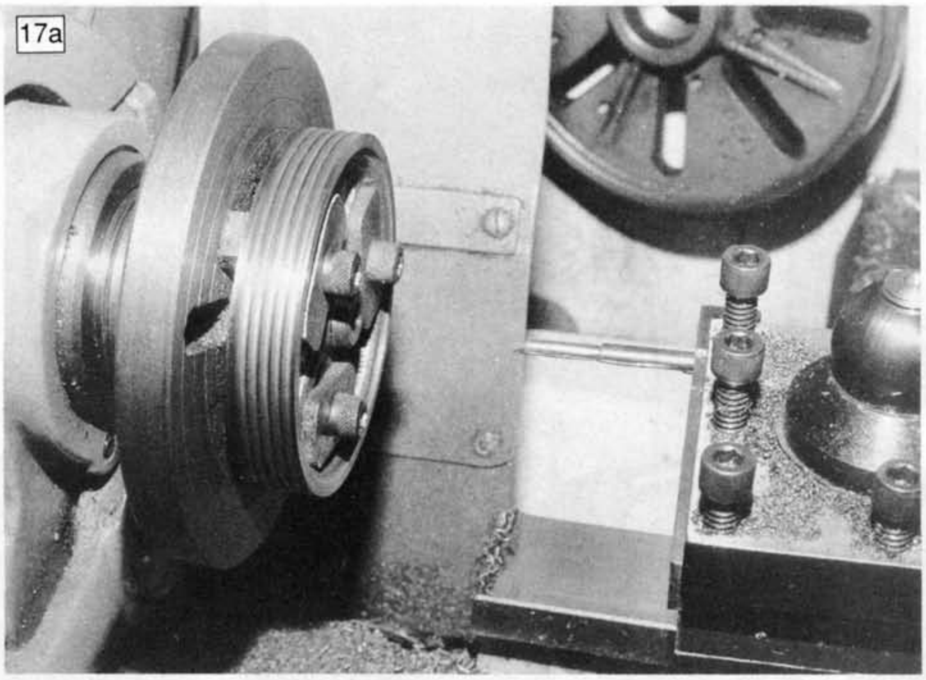
FLYWHEEL RIM GROOVES
Fig. 15



17

16: The Author's lathe catchplate, converted into a small faceplate.

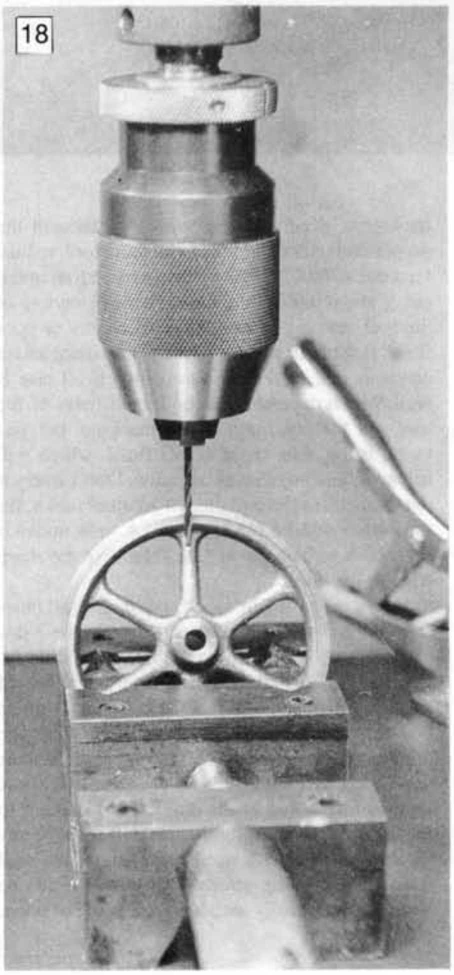
17: Machining the face of the rim with the wheel mounted on the small faceplate shown in Fig 16.



17A: ***Trueing the bore after drilling, using a very small boring tool. The rim has been grooved at this stage.***

18: ***Drilling the grub-screw holes. Paper packing, not visible here, is used to protect the machined surfaces.***

move the tool sideways by 0.09in. using the top-slide index (allow for backlash) and repeat. Then again. Return to the centre, check that zero on the



slide matches the groove, and then follow exactly the same procedure to the left of the centre. You will be surprised how quickly it all goes! However, if you have a very old machine and experience chatter at all, don't worry; just reduce the speed. There is no minimum cutting speed for cast iron. Finally, break the sharp edges using either a very fine file or medium emery on a piece of stick.

Boring

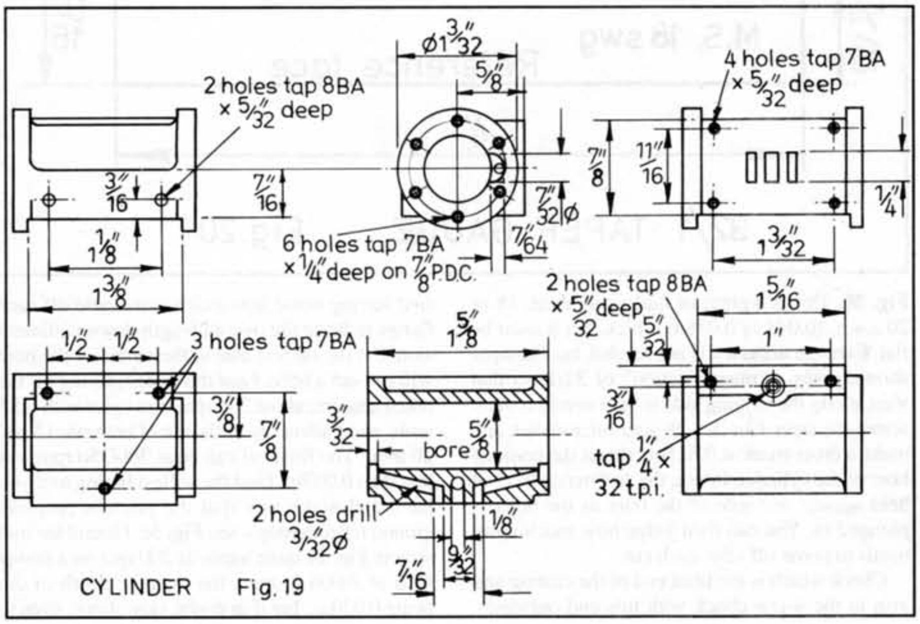
Machine back the face of the boss until it stands proud of the rim by 1/16 inch. This will be easier if you first centre the boss with a Slocumbe drill, as the tool will not then run out to a pip in the middle. If the O.D. of the boss is running out a little it is quite in order to skim it, using a tool with about 1/16in. radius at the tip. Re-centre with a 1/4in. Slocumbe drill and then drill through 7/32in. or 5.6mm. Run at up to 1000 rpm, and feed steadily but gently. If the drill shows signs of "wobbling", due perhaps to porosity within the casting, stop; fit a small Slocumbe, re-centre the bottom of the hole, and start again. Some slight run-out is almost certain, but a real wobble must be treated.

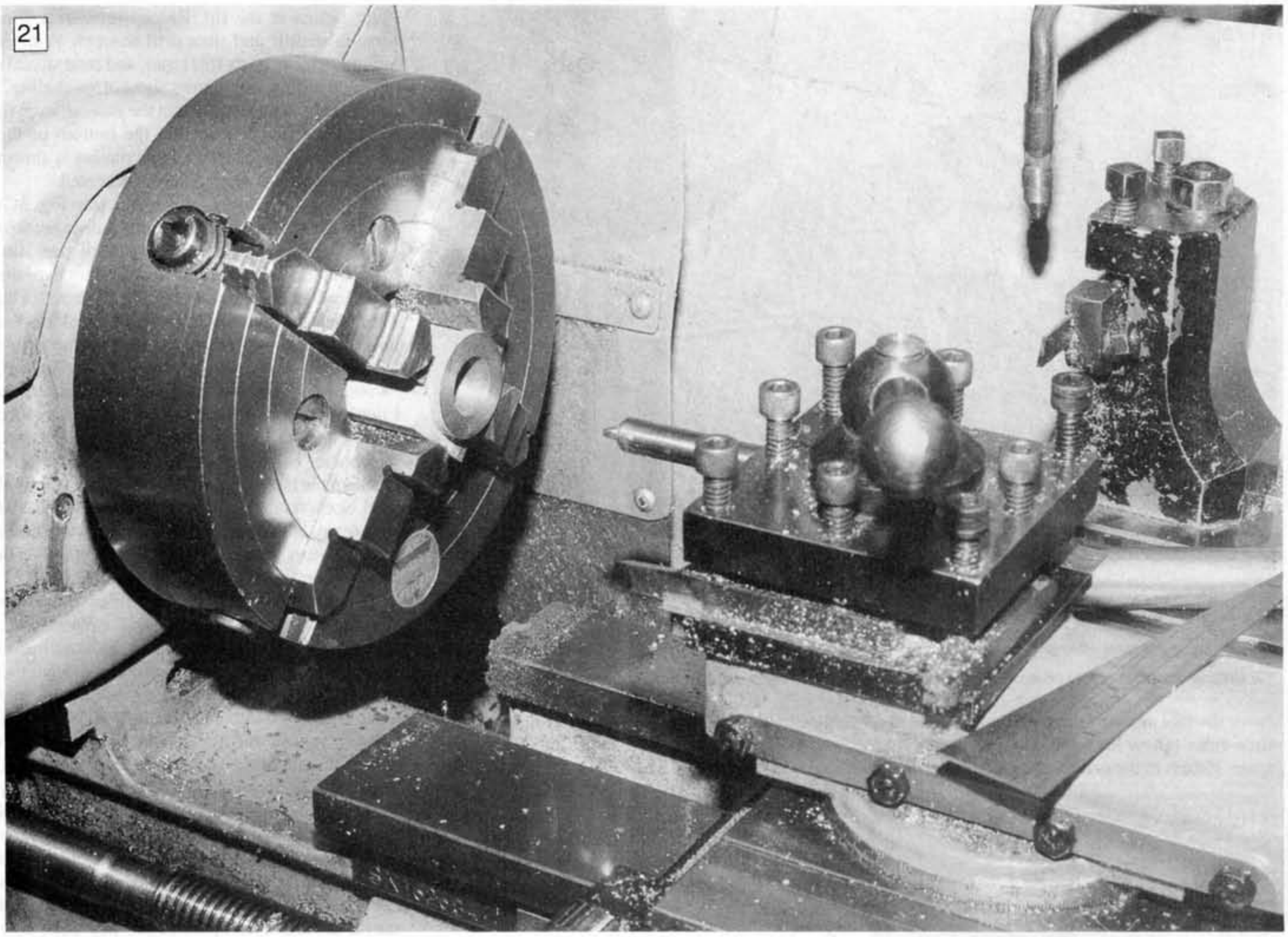
You now need a tiny boring tool, (see **Fig. 3C**) to skim out the hole, but check that it does not foul on the shank. Take very light cuts until your 1/4in. reamer enters by about a third of the length of the taper lead-in. Run at about 600 rpm or so, (**Fig. 17a**). Reduce speed to 200 rpm, fit a reamer in the tailstock chuck, and ream by pushing the whole tailstock forwards, not by using the handwheel. "woodpeck" the hole to clear chips frequently. Lightly countersink the hole. Check with a piece of 1/4in. stock that it runs true. There may be a trace of wobble, but if it runs out a lot, don't worry. Open up the hole to 5/16in., glue in a short length of steel or even brass (whilst still in the chuck) and start again. I have had to do this two or three times over the years, usually due to a casting fault – not common on Stuart castings, I should add!

Take from the faceplate and fit up the 3-jaw with outside jaws. Grip by the rim, tap well back, and then face the side of the rim until the lips to the outside grooves are equal. Face the boss to project 3/16in. and, if necessary, machine it to run true. Lightly countersink the hole. It then only remains to drill for the grubscrew. This should align with one of the spokes and I always fit *two*, at 120 deg., both for security and to even out any slight clearance between shaft and bore. **Fig. 18** shows how to angle the casting when drilling. You cannot see it, but there is a piece of paper between the rim and the slideways of the vice. The jaw is adjusted to give the desired angle. To get a good start to the drill open up the centre-pop using your hand drill first. Wrap up the wheel in dry paper and set aside.

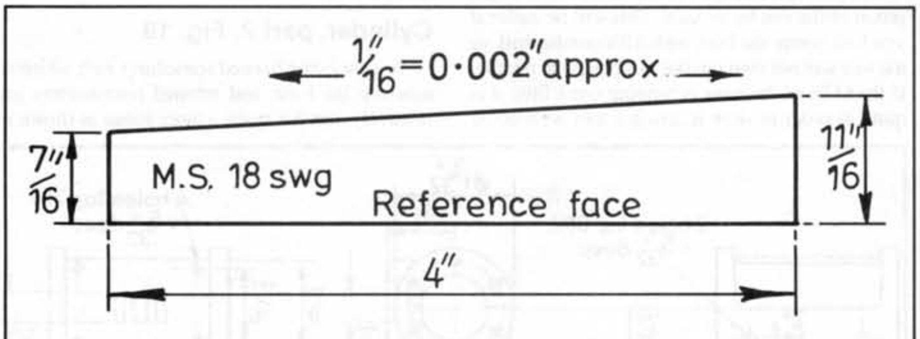
Cylinder, part 2, Fig. 19

You are going to need something with which to measure the bore, and internal micrometers are relatively rare. So, make a taper gauge as shown in





21: ***Boring the cylinder. A taper gauge, similar to that shown in Fig.20, is seen on the top-slide.***



32/1 TAPER GAUGE Fig.20

Fig. 20. This is a piece of fairly stiff sheet, 18 or 20 s.w.g. (0.048 or 0.036in.) thick, but it must be flat. Extreme accuracy is not needed, but the taper shown gives a "magnification" of 32/1, so that 1/16in. along the sloping side is very nearly 0.02in. across the taper. Check with your micrometer, and make a cross-mark at 0.625in.; this is the nominal bore of the cylinder. In use, the "reference face" is held against one side of the bore as the taper is plunged in. You can then judge how much more needs to come off after each cut.

Check which is the front end of the casting and grip in the 4-jaw chuck with this end outwards, first having noted how much is to come off each flange to bring the overall length down to dimension. Set the casting true to the outside – the bore will run out a little. Face the flange, taking off the noted amount; about 200 rpm is in order with HSS tools, and I advise an initial cut of between 15 and 20 thou. The final cut can be at 300/350 rpm, not less than 0.003in. Find the stiffest boring tool you have and make sure that the point is properly ground for roughing – see **Fig. 3c**. I found the tool seen in **Fig. 21** quite happy at 200 rpm on a power feed of 0.006 in./rev., the average depth of cut being 0.020in., but if in doubt, slow down, even to back-gear. When you get within 12 thou of the proper diameter change to a finishing tool, reduce feed rate to 0.002/0.003 in./rev., and take an initial cut of about 0.003 inch. Observe the behaviour of the tool, and if you find traces of chatter or poor finish first check that the tool is really sharp and at centre-height, and then slow down if all else is well. Much depends here on the stiffness of the tool and the condition of the machine, but you ought to be able to get a tool finish which will serve without any further attention. Don't worry if the diameter is the odd thou or so up or down, for the piston will be made to fit. (A thou under is preferable to being over-size.) Remove the sharp edge to the bore.

Find a piece of 5/8in. stock and remove all burrs from the end and the diameter. Chuck in the 3-jaw and apply emery until the cylinder is a slide fit. Clean off all dust and oil, then apply one drop of "Instant" glue and slide on the cylinder. Allow a few minutes to set and then face the second flange until the 1 5/8in. dimension is met. Remove the burr here also. Incidentally, you will see that these flanges are marked 1 3/32in. dia. There is no need to machine them, but a light skim will remove any local protuberances if need be. A smart blow will release the casting, after which any glue can be removed quite easily with a scraper made of brass.

● *To be continued*